REMARKS

Claims 1-23 have been canceled and replaced by new claims 24-43, which are pending. Reexamination and allowance of the pending claims is respectfully requested.

Claims 1-3, 5-8 and 10 stand rejected under 35 U.S.C. 103(a) as being unpatentable over USP 6,358,836 to Lu et al. ("Lu") in view of USP 6,348,399 to Lin ("Lin"). Claims 4 and 9 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Lu in view of Lin, and further in view of USP 5,903,058 to Akram ("Akram"). Claims 11-14, 16-21 and 23 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Lu in view of Lin, and further in view of USP 6,489,229 to Sheridan et al. ("Sheridan"). Claims 15 and 22 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Lu in view of Lin, and further in view of Sheridan and Akram. These rejections are respectfully traversed.

Claims 1-23 have been canceled without prejudice, thereby rendering these rejections moot. New claims 24-43 have been added.

New independent claim 24 recites, among other limitations, that:

(i) the seed layer is solely made of a first metal material,

(ii) the solder bump contains at least the first metal material, and

(iii) the seed layer beneath the solder bump dissolves completely into the solder bump after a reflow process and disappears.

Support for these limitations can be found in FIGS. 3E to 3F and at page 8, lines 8-11 of the present invention. None of the cited prior art discloses or suggest a seed layer which dissolves completely into the solder bump. In this regard, it is well known in the art that the strength of a structure will decrease as more layers are formed between the contact pad and the solder bump. Since the seed layer will be dissolved into the solder bump, very few layers are formed between the contact pad and the solder bump. As a result, the present invention provides better structural strength and adhesion, especially between the contact pad and the solder bump.

New independent claim 34 recites, among other limitations, that:

(i) the contact pad is made of copper, and

(ii) directly forming a thin metal seed layer over the surface without performing any roughness processing to the contact pad, with the seed layer

being solely made of a first metal material which has good adhesion with copper.

Support for these limitations can be found in FIGS. 3G and 4A-4C, and on page 6, lines 8-9, page 9, lines 1-3, and page 10, lines 11-24 of the specification of the present invention. None of the cited prior art disclose or suggest these limitations.

First, it is well know in the art that, the contact pads formed on a silicon substrate are mostly made of "aluminum" because aluminum has much lower fusion temperature and much better adhesion with silicon than copper. However, it is also well known in the art that the solder bump is usually made of an alloy of tin, lead or copper, which has very bad adhesion with aluminum. As a result, the prior art technique to form a solder bump on the contact pad of a silicon substrate must first perform a roughness processing to the surface of the contact pad to increase its adhesion ability, and then form an additional barrier layer which contains titanium, TiN, nickel, chromium or gold to act as an interlayer between the solder bump and the contact pad, and then form the solder bump on the barrier layer. It is impossible for a silicon substrate to either form a seed layer made of copper or a solder bump directly onto the contact pad due to the poor adhesion property between aluminum and copper or tin. In contrast, for the organic substrate of the present invention, since the contact pad is made of copper (which has very good adhesion with solder bumps), therefore there is no need for the present invention to either apply roughness processing or form additional barrier layers on the top surface of the contact pad.

The applicant respectfully submits that, there are significant differences between the processes for forming the electroplated solders on a silicon substrate and an organic substrate. It is impossible to employ the techniques and processes of silicon substrate directly to an organic substrate. It is noted that the passivation layer formed on the silicon substrate (as which disclosed in USP 6358836) is made of silicon oxide or silicon nitride, which are capable of being exposed to high temperature and acid/alkali environments. However, solder masks used on an organic substrate are made of light-sensitive epoxy resin or acrylic resin which cannot tolerate high temperature nor high acid/alkali environments. In addition, the semiconductor processes, chemical solutions and

conditions of manufacturing of UBM forming Bump of silicon substrates are absolutely different from the manufacturing processes and conditions and chemical solutions of the electroplated solders for the organic substrate. It is impossible to directly employ the semiconductor processes of USP 6358836 to the organic substrate of the present invention. Moreover, Figures 5A-5E of USP 6358836 disclose a process to form Via Plugs on a silicon substrate to act as internal conductive circuits, which is absolutely different from the electroplated solders which are for use in the external bonding of the organic substrate of the present invention. Not only are the objectives different, but the techniques, functions and processes involved are different as well.

Other arguments about why the prior art techniques relating to contact pads and solder bumps of silicon substrates cannot be applied to the present invention can be found in the previous Amendment filed by Applicant, and from page 6 lines 28 to page 7, line 18 of the specification of the present invention.

In light of these reasons, it is respectfully submitted that all pending claims are in condition for allowance. The Examiner is encouraged to telephone the undersigned if there are informalities that can be resolved in a phone conversation, or if the Examiner has any ideas or suggestions for further advancing the prosecution of this case.

Respectfully Submitted,

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By: _____
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